



Abstract. Although the importance of Education for Sustainable Development in Early Childhood (ECEfS) is widely acknowledged, its implementation varies across different national, institutional, and individual contexts. This quantitative study involved 398 ECE teachers from Bosnia and Herzegovina, Croatia, and Slovenia. The aim of the research was to identify differences in the implementation of specific dimensions of ECEfS and in the achieved sustainability outcomes among children, with respect to three levels of ECE teachers' professional context: national, institutional, and individual. Data were collected via an online survey and analyzed using descriptive statistics, ANOVA, and t-tests. While the study was limited by reliance on self-assessment and purposive sampling, it provided valuable insights into how professional context shapes early sustainability practices and outcomes and raised questions for future research. Findings indicate the existence of differences among respondents from different countries in the level of implementation of certain aspects of early childhood education for sustainable development, as well as in children's sustainability outcomes. Similar differences were identified between ECE teachers working in eco and non-eco kindergartens, and between those familiar and unfamiliar with the activities of the ECE Academy. The results highlight the importance of institutional context and professional development in supporting sustainability practices in early childhood education settings.

Keywords: early childhood education for sustainable development, eco-program, ECE Academy, Bosnia and Herzegovina, Croatia, Slovenia

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BRIDGING THE INDIVIDUAL AND THE SYSTEM: PRESCHOOL TEACHERS' AGENCY IN IMPLEMENTATION FOR SUSTAINABLE DEVELOPMENT IN EARLY CHILDHOOD SETTINGS IN SOUTH-EASTERN EUROPE

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Introduction

Preschool teachers (ECE teachers) are increasingly expected to play an active role in addressing complex global challenges such as climate change, inequality, and unsustainable lifestyles—yet many lack adequate support or clear guidance on how to implement Education for Sustainable Development (ESD) in early childhood settings. The early years represent a unique window of opportunity to foster sustainability-related values, habits, and ways of thinking (UNESCO, 2020), but how these opportunities are realized is strongly shaped by broader institutional, national, and personal contexts. Despite the increasing global emphasis on ECEfS, empirical research is still limited, including in South-Eastern Europe. This study seeks to partially address this gap by examining whether national, institutional, and individual factors among ECE teachers included in the study are related to the implementation of ECEfS and its outcomes. While the study focuses on participants from three countries in South-Eastern Europe, the findings offer regionally relevant insights that may inform further national and international discussion on ECEfS implementation.

Framework of Early Childhood Education for Sustainability

Education for Sustainable Development (ESD) empowers participants with the knowledge, skills, and values necessary to make informed decisions and act to preserve the planet and improve society (UNESCO, 2024). The integration of ESD into the early education system, known as Early Childhood Education for Sustainability (ECEfS), enables children to develop sustainability awareness from an early age through play, interactive activities, and daily routines. Special attention is given to identifying and validating effective educational practices, strategies, and approaches for implementing



ECEfS (UNESCO, 2017). Positive changes in ECEfS have stemmed from new interpretations of children's rights, the redefinition of the teacher's role, and the need to critically reflect on ESD (Davis et al., 2024), while contemporary trends emphasize transformative processes (Feriver et al., 2023; Mogren, 2024), learning spaces in early childhood (Engdahl & Furu, 2022), inclusive approaches and children's activism (Garcia Manas, 2024), and stronger links with the local community (Šindić et al., 2025a), with ECE teachers playing a pivotal role in all these aspects (Višnjić-Jevtić et al., 2022).

Three Dimensions of ECEfS: Ecological, Social, and Economic

The concept of sustainable development is multilayered, comprising interrelated ecological, social, and economic dimensions. ECEfS incorporates these “three pillars of sustainability” into children's daily experiences (UNESCO, 2017). The ecological dimension is often viewed as the core focus by practitioners (Engdahl et al., 2021; Güler Yıldız et al., 2021; Višnjić-Jevtić et al., 2022). It includes nature-based play and learning about living organisms, fostering emotional connections with nature and pro-environmental attitudes (Davis & Elliott, 2024), shaping values and responsible lifestyles (Lamauskas, 2023), with increasing emphasis on direct engagement with natural environments (Nazaruk & Klim-Klimaszewska, 2017). The social dimension involves nurturing cooperation, empathy, respect for diversity, and social responsibility through participatory and inclusive approaches (Elliott & Davis, 2009; Garcia Manas, 2024). Children are recognized as capable contributors who promote justice, equity, and human rights (Engdahl et al., 2022; UN, 2015). Economic sustainability is addressed through activities that encourage rational consumption, saving, and care for shared resources, introducing children to values that support the long-term well-being of their communities (Davis & Elliott, 2024). This dimension is increasingly embedded in everyday ECE practices and routines (Hosany et al., 2022; Mahat et al., 2016; Šindić & Lepičnik Vodopivec, 2025; Šindić et al., 2025a).

Contemporary studies have confirmed the prevalence of holistic and integrative approaches in ECEfS, which aim to achieve ecological, social, and economic sustainability outcomes, along with broader sustainable behaviors (Engdahl et al., 2022; Lepičnik Vodopivec & Šindić, 2025; Nazaruk & Klim-Klimaszewska, 2017; Samuelsson & Kaga, 2008; Watt & Frydenberg, 2024). These outcomes are enabled through well-designed strategies that emphasize experiential learning and child participation.

ECEfS Learning Outcomes

Within ECEfS, learning outcomes encompass both foundational knowledge and sustainable behaviors across ecological, social, and economic dimensions. As young children are still developing the ability to grasp complex sustainability concepts, ECEfS places greater emphasis on fostering sustainable behavior through experiential learning (Lepičnik Vodopivec & Šindić, 2025). Activities such as gardening, nature-based play, and daily routines—like saving energy or sorting waste—encourage the development of pro-environmental and prosocial habits (Ernst et al., 2021; Ginsburg & Audley, 2020; Hughes, 2023; Kuo et al., 2019; Mahat et al., 2016; Poje et al., 2024).

Lepičnik Vodopivec and Šindić (2025) have shown that the integration of an ecological program into standard preschool curricula enhances ecological learning outcomes, fosters sustainable behaviors, and contributes to overall sustainability-related achievements through strategies that engage children in exploration, critical thinking, and community participation. Similarly, Nazaruk and Klim-Klimaszewska (2017) demonstrated that authentic nature experiences (e.g., in meadows, parks, forests, zoos) significantly improve cognitive, emotional, and social outcomes. Following a six-month program, children exhibited greater environmental knowledge, curiosity, empathy, and care for nature—confirming the value of inquiry-based, hands-on learning in supporting diverse sustainability competencies. Contemporary programs are continuously evolving to design and evaluate approaches that effectively foster sustainability outcomes in early education across all three dimensions (Davis et al., 2024).

Contextual Specificities in the Implementation of ECEfS in Three Countries

Educational policies may vary across countries due to differing national and local priorities (Güler Yıldız et al., 2021; Kahriman-Pamuk & Borg, 2024), and the integration of ECEfS requires strategic support that aligns with each country's unique context (Višnjić-Jevtić et al., 2022). Research by Šindić et al. (2022) has shown that Bosnia and Herzegovina, Croatia, and Slovenia implement all three dimensions of ECEfS to a similar extent, although some

variation exists in how strongly the ecological pillar is emphasized. While ECE teachers across all three countries tend to identify the ecological dimension as the most prominent component of ECEfS (Višnjić-Jevtić et al., 2022), findings from more recent studies suggest that the social dimension may actually be the most prevalent in practice—among respondents from Bosnia and Herzegovina (Šindić et al., 2025b), Croatia (Anđić, 2024), and Slovenia (Lepičnik Vodopivec & Šindić, 2025). In all three contexts, however, the focus is primarily on activities situated within the preschool institution itself, as opposed to those that include broader community engagement and have a more participatory or transformative character (Šindić & Lepičnik Vodopivec, 2025; Šindić et al., 2025a, 2025b). This may suggest that ECE teachers included in these studies are not yet fully familiar with the concept of ECEfS and its intentional implementation, which may often occur spontaneously or intuitively in everyday practice (Šindić & Lepičnik Vodopivec, 2025). These insights point to the potential value of further professional development opportunities in the area of ECEfS for ECE teachers across all three countries. Despite shared educational traditions, contemporary approaches differ notably, especially in systemic support and the role of ECEfS in practice. Višnjić-Jevtić et al. (2022) observed that such differences are linked to education policies, preschool infrastructure, and available institutional support.

In Bosnia and Herzegovina, ECEfS is not systematically integrated into educational policies. The preschool curriculum is neither unified nor explicitly aimed at sustainable development. ECE teachers are often without formal or non-formal ECEfS training, acting on personal initiative. As a result, ECEfS practices tend to be fragmented and largely dependent on individual enthusiasm and local circumstances (Višnjić-Jevtić et al., 2022). Nevertheless, Šindić et al. (2022) found no major differences in the overall presence of ECEfS compared to the other countries, although the ecological dimension is implemented to a lesser degree.

In Croatia, a formal national framework for ECEfS has not yet been fully developed. Nevertheless, ECE teachers frequently demonstrate practices that incorporate all three dimensions of sustainability—ecological, social, and economic—drawing on their experience with project-based learning and their openness to innovation (Anđić, 2024; Višnjić-Jevtić et al., 2022). Despite the absence of strong systemic support, many successfully integrate ECEfS into daily routines (Anđić, 2024). Poje et al. (2024) highlighted the role of specialized programs, particularly eco-programs, in enhancing preschoolers' knowledge of and attitudes toward sustainability. These findings underline the need to formally embed sustainability into Croatia's national preschool curriculum.

In Slovenia, the national preschool curriculum explicitly emphasizes and is guided by the principle of sustainability (Kurikulum za vrtce, 2025). Many preschools participate in international eco-programs (Lepičnik Vodopivec & Šindić, 2025). Dolenc Orbančič and Kovač (2021) found that future ECE teachers are aware of ecological education and behavior, but stress the importance of consistent professional support in this area. Despite institutional support, Višnjić-Jevtić et al. (2022) reported that practice still focuses primarily on the ecological dimension. This suggests that a visible national or institutional framework alone does not ensure full implementation, and that ongoing teacher training remains essential for achieving comprehensive ECEfS.

Institutional Support for ECEfS through the Eco-School/Eco-Kindergarten Program

The international Eco-School/Eco-Kindergarten network, coordinated by the Foundation for Environmental Education (FEE), includes numerous early childhood institutions across different countries. Although primarily ecologically focused, this network provides an integrated framework for Education for Sustainable Development (ECEfS), linking ecological, social, and economic themes through everyday kindergarten activities. Its core mission is to empower children, educators, and families to take active roles in promoting sustainable development through hands-on practices, play, and project-based learning that nurture environmental awareness and sustainable habits (Lepičnik Vodopivec & Šindić, 2025).

In Slovenia, many kindergartens are affiliated with the Eco-School/Eco-Kindergarten network, which offers structured support, monitoring, and thematic focus areas. This enables preschools to align pedagogical goals with sustainability principles and contributes to more effective ECEfS implementation (Lepičnik Vodopivec & Šindić, 2025). In Croatia, the program is actively implemented through diverse activities with children and the local community, promoting sustainability competencies. In contrast, in Bosnia and Herzegovina, research participants reported that kindergartens were not involved in the Eco-School/Eco-Kindergarten network, nor was there evidence of institutional affiliation with these international initiatives. This highlights additional disparities in formal support for ECEfS across national contexts.



ECE Academy as a Tool for the Individual Professional Empowerment of Early Childhood ECE Teachers in the Field of Sustainability

The course *Sustainability from the Start*, developed within the ECE Academy as part of an international Erasmus+ project (OID E10155642), represents an innovative approach to individualized professional learning in the field of early childhood education for sustainability (ECEfS). Unlike traditional formats, *Sustainability from the Start* is a freely accessible online application that enables flexible, self-paced learning tailored to educators' professional needs. Placing particular emphasis on practical activities and the integration of sustainable practices into the daily work of ECE teachers, the course ensures direct applicability and relevance across diverse educational settings. It consists of eight modules that address essential themes such as connecting with nature, fostering inclusive communities, understanding the responsible use of resources, encouraging active citizenship, and promoting collaboration for a sustainable future (ECE Academy, 2023). Each module offers a combination of key theoretical foundations and concrete examples of activities, along with adaptable materials and pedagogical guidance. By leveraging the advantages of digital technology, the ECE Academy course provides a comprehensive, user-friendly, and scalable model of professional empowerment that supports early childhood educators in meaningfully embedding sustainability into everyday practice (ECE Academy, 2023).

Research Problem and Focus

Despite the growing international interest in ECEfS, uncertainties remain regarding its optimal, comprehensive, and balanced implementation within diverse national and institutional settings. Existing studies rarely examine the combined roles of national educational policy, institutional engagement, and individual professional development in relation to ECEfS practices and sustainability outcomes in children. Contemporary approaches increasingly recognize the relevance of non-formal professional development as a supplement to formal training in early childhood education. In this study, familiarity with the content of the ECE Academy is examined as one possible indicator of individual professional development, analyzed in relation to national context (i.e., differences among countries) and institutional framework (i.e., whether the preschool participates in an eco-program). The research addresses a multilayered set of factors that may shape the implementation of sustainability-related practices in preschool settings, in order to provide a broader view of whether systemic, institutional, and individual dimensions are associated with ECEfS outcomes. The study focuses on identifying and analyzing variability in the implementation of ECEfS and in sustainability-related outcomes among children, considering three levels of professional context among ECE teachers included in the study: the national level (country of employment), the institutional level (eco-program participation), and the individual level (familiarity with ECE Academy content).

Research Aim and Research Hypotheses

The aim of this study was to examine differences in the implementation of specific dimensions of Education for Sustainability in Early Childhood (ECEfS) and in the sustainability outcomes achieved among children, with respect to three levels of the participants' professional position—ECE teachers: the national level (country of employment), the institutional level (institution's involvement in an eco-program), and the individual level (non-formal professional development through the ECE Academy course). In accordance with this aim, the following hypotheses were formulated:

Hypothesis 1: There are statistically significant differences in the extent to which the dimensions of ECEfS are implemented among ECE teachers involved in the research from Bosnia and Herzegovina, Croatia, and Slovenia, as well as in the sustainability outcomes achieved by children in their preschool groups.

Hypothesis 2: There are statistically significant differences in ECEfS practices between ECE teachers employed in preschool institutions with and without an eco-program, as well as in the sustainability outcomes achieved by children in their preschool groups.

Hypothesis 3: There are statistically significant differences in the implementation of ECEfS between ECE teachers familiar with the ECE Academy course activities and those who are not, as well as in the sustainability outcomes achieved by children in their preschool groups.



Research Methodology

General Background

This quantitative, non-experimental, causal-comparative study was conducted as part of a broader international research project focused on ECEfS in South-Eastern Europe. The study was carried out in 2024 with ECE teachers from Bosnia and Herzegovina, Croatia, and Slovenia. It examined whether national context, institutional participation in eco-programs, and individual engagement in non-formal professional development (through the ECE Academy course) were associated with variations in reported practices and sustainability-related outcomes. A convenience sampling method was applied to recruit participants from the wider early childhood education community. The study was grounded in a holistic understanding of sustainability in early childhood, emphasizing the interconnected ecological, social, and economic dimensions that shape everyday educational practice.

Sample

The target population included early childhood education (ECE) teachers working in preschool institutions across the three participating countries. From this population, a convenience sample of $N = 343$ ECE teachers was recruited through an online survey conducted in 2024. The sample consisted of $n = 115$ participants from Bosnia and Herzegovina, $n = 114$ from Croatia, and $n = 114$ from Slovenia. Although not representative of the entire ECE teacher population in these countries, the sample offered valuable insights into regional trends due to its diverse national and institutional composition.

The vast majority of participants were women (98.3%). Less than half of the participants (40.2%) were employed in preschool institutions actively involved in the Eco-School/Eco-Kindergarten network. At the time of the study, less than one-quarter (23%) of the participants were familiar with the activities offered in the ECE Academy course. Table 1 provides an overview of the respondents' characteristics.

Table 1
Professional and Demographic Characteristics of ECE Teachers

Sample structure		<i>f</i>	%
Country	Bosnia and Herzegovina	115	33.5
	Slovenia	114	33.2
	Croatia	114	33.2
Years of work experience	Up to 10 years	136	39.7
	From 10 to 20 years	103	30
	Over 30 years	64	18.7
	Up to 10 years	40	11.7
ECE teachers work in	Nursery (children up to 3 years old)	93	27.1
	Kindergarten (children aged 3 to 6 years old)	250	72.9
ECE educators in eco-program	Yes	138	40.2
	No	205	58.8
ECE teachers' preschool participation in eco-program by countries	Bosnia and Herzegovina	0	0
	Croatia	52	37.68
	Slovenia	86	62.32
Familiarity with the ECA course	Yes	79	23
	No	264	77
Familiarity with the ECA course by countries	Bosnia and Herzegovina	21	26.6
	Croatia	53	67.1
	Slovenia	5	6.3

Notes. *f* – frequency; % – percentage

Variables

For the purposes of this study, independent and dependent variables were defined. The independent variables included the country of employment of ECE teachers involved in the research (Bosnia and Herzegovina (B&H), Croatia (Cro), and Slovenia (Slo)), the presence of an eco-program in the preschool, and the familiarity with ECE Academy activities. The dependent variables were: EES (Education for Ecological Sustainability), ESS (Education for Social Sustainability), EECS (Education for Economic Sustainability), and ECEfS (the integrated implementation of all aspects of education for sustainable development). In addition, the study examined SB (Adopted Sustainable Behavior), FSE (Familiarity with Sustainability Elements), and O-SD (Overall Sustainability Outcomes).

Instrument and Procedure

The instrument used in this study was developed in accordance with contemporary recommendations for education for sustainable development (UNESCO, 2017), as well as the OMEP ESD Rating Scale (2019), which assesses the promotion of sustainability in early childhood. The first part of the instrument focused on demographic and professional data (5 items), while the second part consisted of 34 closed-ended items, arranged 5-point Likert scale, covering the key elements of ECEfS. The instrument had previously been used in an earlier phase of the same international project, in a study conducted in Slovenia (Lepičnik Vodopivec & Šindić, 2025), where its theoretical foundations, content validity, and preliminary reliability results were thoroughly presented. In the present study, the instrument was applied to a broader sample of participants from three countries—Slovenia, Croatia, and Bosnia and Herzegovina—with a specific focus on the independent variables: country of employment, participation in an eco-program, and familiarity with ECE Academy activities.

The empirical validity of the instrument was confirmed through principal component analysis, with the first factor explaining 35.52% of the total variance. According to the criteria proposed by Hair et al. (2014), which consider a threshold of 30% acceptable for interpretation in social science research, these results indicated satisfactory structural validity of the instrument. The reliability of the instrument was verified by calculating the Cronbach's alpha coefficient on this sample, which showed high internal consistency ($\alpha = .93$). The use of closed-ended questions, standardized instructions, and non-interventional online data collection ensured the objectivity of the instrument.

Data Collection and Analysis

The Ethics Committee of the Faculty of Teacher Education (University of Zagreb) reviewed and approved the research protocol. Data were collected in 2024 across three countries—Bosnia and Herzegovina, Croatia, and Slovenia—as part of a broader regional research project on education for sustainable development in early childhood education (ECEfS). Participation was voluntary, anonymous, and conducted via an online survey platform. Data obtained from the respondents were analyzed using IBM SPSS Statistics (Version 26). To examine the metric characteristics of the instrument, Principal Component Analysis (PCA) and Reliability Analysis were performed. Considering the sample size, the Kolmogorov-Smirnov test was used to assess the normality of distribution. Although some deviations from normality were observed, parametric tests were retained due to the sufficiently large sample size ($n > 30$ per group), as such tests are considered robust under these conditions (Pallant, 2020). The following statistical procedures were applied: descriptive statistics (mean and standard deviation), one-way analysis of variance (ANOVA) to examine differences among participants from different countries (Table 2), and independent samples *t*-tests to compare participants from institutions with and without an eco-program (Table 3), as well as those familiar and unfamiliar with the activities of the ECE Academy (Table 4).

Research Results

Through three hypotheses, the study tested differences in the extent of implementation and outcomes of ECEfS based on the country, program involvement, and professional awareness of the participating ECE teachers.

Examination of Hypothesis 1

To test Hypothesis 1, a one-way ANOVA was conducted to examine differences in the mean scores of variables related to the implementation and achieved outcomes of ECEfS among ECE teachers involved in the research from

Bosnia and Herzegovina, Croatia, and Slovenia. The results were presented in Table 2. The results indicated that, in terms of the implementation of education for ecological sustainability (EES), participants from Slovenia ($M = 3.62$) and Croatia ($M = 3.46$) reported, on average, a higher level of inclusion of this aspect compared to participants from Bosnia and Herzegovina ($M = 3.29$), with the difference being statistically significant ($F(2, 340) = 6.58; p = .002$). Similarly, education for economic sustainability (EEcS) was reported to be significantly more represented among Croatian participants ($M = 3.86$) in comparison to their counterparts from Bosnia and Herzegovina ($M = 3.38$) and Slovenia ($M = 3.44$), with a highly significant statistical difference ($F(2, 340) = 15.11; p < .001$). A statistically significant difference was also found for the outcome familiarity with sustainability elements (FSE), where Croatian participants reported a higher average score ($M = 3.75$) than participants from BiH ($M = 3.52$) and Slovenia ($M = 3.49$) ($F(2, 340) = 3.23; p = .041$).

Table 2

Differences in the Representation of ECEfS Aspects and Outcomes Among Participants from Different Countries (ANOVA)

Variable	Country	N	M	SD	F	p
EES	B&H	115	3.29	0.78	6.58	.002
	Slo	114	3.62	0.64		
	Cro	114	3.46	0.63		
ESS	B&H	115	3.93	0.50	1.22	.298
	Slo	114	3.87	0.55		
	Cro	114	3.82	0.59		
EEcS	B&H	115	3.38	0.77	15.11	<.001
	Slo	114	3.44	0.67		
	Cro	114	3.86	0.71		
ECEfS	B&H	115	3.53	0.62	2.82	.061
	Slo	114	3.64	0.56		
	Cro	114	3.71	0.56		
SB	B&H	115	3.64	0.78	1.03	.360
	Slo	114	3.76	0.65		
	Cro	114	3.65	0.75		
FSE	B&H	115	3.52	0.85	3.23	.041
	Slo	114	3.49	0.89		
	Cro	114	3.75	0.73		
O-SD	B&H	115	3.58	0.80	0.69	.504
	Slo	114	3.63	0.74		
	Cro	114	3.70	0.72		

Notes. N – number of participants; M – arithmetic mean; SD – standard deviation; F – Fisher's coefficient; p – statistical significance; Full variable labels are available in the *Variables* subsection of the *Research Methodology*.

Education for social sustainability (ESS), overall sustainability outcomes (O-SD), adopted sustainable behavior (SB), and integrated implementation of all aspects of ECEfS, the differences among countries were not statistically significant ($F(2, 340) = 1.22, p = .298$; $F(2, 340) = 0.69, p = .504$; $F(2, 340) = 1.03, p = .360$; $F(2, 340) = 2.82; p = .061$). Although the mean scores for integrated ECEfS implementation were slightly higher among Croatian participants ($M = 3.71$) compared to those from Slovenia ($M = 3.64$) and BiH ($M = 3.53$), this difference did not reach the threshold for statistical significance. Based on the results presented in Table 2 and their interpretation, Hypothesis 1 was partially confirmed.

Examination of Hypothesis 2

To test Hypothesis 2, an Independent Samples t-test was conducted to examine differences in the mean scores of variables related to the implementation and achieved outcomes of ECEfS among ECE teachers employed in kindergartens with and without an eco-program. The results obtained were presented in Table 3. The results of the t-test indicated that ECE teachers employed in institutions that were part of the Eco-Kindergarten network implemented certain aspects of education for sustainable development to a significantly greater extent than ECE teachers from institutions not affiliated with the network. Specifically, education for ecological sustainability (EES) was significantly more represented among teachers from eco-kindergartens ($M = 3.60$) compared to those from other institutions ($M = 3.36$), with the difference being statistically significant ($t(341) = 3.09$; $p = .002$). Similarly, education for economic sustainability (EecS) was more prominent among teachers from eco-kindergartens ($M = 3.67$) than among their colleagues from non-eco institutions ($M = 3.48$), with a statistically significant difference ($t(341) = 2.33$; $p = .020$).

Table 3

Differences in the Representation of ECEfS Aspects and Outcomes Among ECE Teachers in Institutions With and Without an Eco-program

	Eco program	N	M	SD	t	p
EES	With	138	3.60	0.62	3.09	.002
	Without	205	3.36	0.73		
ESS	With	138	3.88	0.57	0.19	.849
	Without	205	3.87	0.54		
EEcS	With	138	3.67	0.70	2.33	.020
	Without	205	3.48	0.77		
ECEfS	With	138	3.71	0.55	2.16	.032
	Without	205	3.57	0.60		
SB	With	138	3.78	0.64	2.03	.043
	Without	205	3.62	0.77		
FSE	With	138	3.66	0.79	1.36	.174
	Without	205	3.54	0.86		
O-SD	With	138	3.72	0.67	1.74	.083
	Without	205	3.58	0.79		

Notes. N – number of participants; M – arithmetic mean; SD – standard deviation; t – t-value; p – statistical significance; Full variable labels are available in the Variables subsection of the Research Methodology.

Significant differences were also identified in the implementation of an integrated approach to sustainability education (ECEfS), which includes all dimensions of sustainability. According to the ECE teachers' assessments, this approach was, on average, more frequently implemented in kindergartens with an eco-program ($M = 3.71$) than in those not part of the eco-kindergarten network ($M = 3.57$), with the difference reaching statistical significance ($t(341) = 2.16$; $p = .032$). In addition, based on ECE teachers' observations, children in eco-kindergartens demonstrated a higher level of adopted sustainable behavior (SB) ($M = 3.78$) compared to children in other institutions ($M = 3.62$), with the difference also being statistically significant ($t(341) = 2.03$; $p = .043$).

For education for social sustainability (ESS), familiarity with sustainability elements (FSE), and overall sustainability outcomes (O-SD), the differences between the groups were not statistically significant. For example, the mean values for ESS were nearly identical among teachers from eco-kindergartens ($M = 3.88$) and those from other institutions ($M = 3.87$), with no significant difference ($t(341) = 0.19$; $p = .849$), indicating that the social dimension is not specifically emphasized within the eco-kindergarten network. Similarly, although the mean values for FSE and O-SD were slightly higher among teachers from eco-institutions, the differences did not reach the threshold of statistical significance ($p = .174$ and $p = .083$, respectively). The results shown in Table 3 and their interpretation indicate that Hypothesis 2 was partially supported.



Examination of Hypothesis 3

To test Hypothesis 3, an Independent Samples *t*-test was conducted to examine differences in the mean scores of variables related to the implementation and achieved outcomes of ECEfS between ECE teachers who were familiar with the activities of the ECE Academy and those who were not. The results are presented in Table 4. The results of the *t*-test showed that ECE teachers who were familiar with the activities of the ECE Academy implemented certain aspects of education for sustainable development to a greater extent, and that children in their groups achieved higher scores on some indicators of sustainability outcomes. Specifically, education for economic sustainability (EEcS) was significantly more represented among those familiar with the ECE Academy activities ($M = 3.75$) compared to other participants ($M = 3.50$), with the difference being statistically significant ($t(341) = 2.63$; $p = .009$). A significant difference was also observed in the domain of familiarity with sustainability elements (FSE), where participants familiar with the course reported a higher average score ($M = 3.83$) compared to those who were not familiar ($M = 3.51$), with the difference reaching statistical significance ($t(341) = 3.03$; $p = .003$).

Table 4

Differences in the Representation of ECEfS Aspects and Outcomes Among Participants Familiar and Unfamiliar with ECE Academy Activities

	Familiarity with ECE Academy	<i>N</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
EES	Yes	79	3.51	0.69	0.75	.453
	No	264	3.44	0.70		
ESS	Yes	79	3.93	0.55	1.09	.277
	No	264	3.86	0.55		
EEcS	Yes	79	3.75	0.72	2.63	.009
	No	264	3.50	0.75		
ESD	Yes	79	3.73	0.57	1.76	.079
	No	264	3.60	0.59		
SB	Yes	79	3.79	0.66	1.52	.129
	No	264	3.65	0.74		
FSE	Yes	79	3.83	0.68	3.03	.003
	No	264	3.51	0.86		
O-SD	Yes	79	3.81	0.65	2.41	.016
	No	264	3.58	0.77		

Notes. *N* – number of participants; *M* – arithmetic mean; *SD* – standard deviation; *t* – *t*-value; *p* – statistical significance; Full variable labels are available in the Variables subsection of the Research Methodology.

Furthermore, the overall sustainability outcomes (O-SD) were significantly higher in the groups of participants who were familiar with the activities of the ECE Academy course ($M = 3.81$) compared to those who were not familiar ($M = 3.58$), with the difference reaching statistical significance ($t(341) = 2.41$; $p = .016$). For the remaining variables—education for eco (EES) and social (ESS) sustainability, adopted sustainable behavior (SB), and integrated implementation of all aspects of education for sustainable development (ECEfS)—no statistically significant differences were found ($p > .05$), although the average values were consistently slightly higher among participants familiar with the course activities. Based on the results presented in Table 4 and their interpretation, Hypothesis 3 was partially confirmed.

Discussion

The findings indicated the presence of a certain degree of consistency and specific differences in the overall approach to education for sustainable development and in key sustainability outcomes observed among participants from all three countries. These results may point to emerging trends of similarity and divergence in the

implementation of ECEfS and its outcomes across the region where the study was conducted, which should be further examined and confirmed through future research based on representative samples of ECE teachers. The observed differences among participants from different countries were primarily related to the ecological and economic dimensions of sustainability, as well as to their familiarity with sustainability elements and the perceived sustainable behavior of children. At the same time, the results suggested a degree of consistency in the overall approach to ECEfS and in sustainability behavior outcomes observed among participants from all three countries. This pattern of results is consistent with previous research (Šindić et al., 2022; Višnjić-Jevtić et al., 2022), which has highlighted the role of educational policies and institutional support in shaping the implementation of ECEfS within national contexts. For example, the economic dimension (EEcS) has been shown to be less represented among participants from Bosnia and Herzegovina compared to the other two countries (Šindić et al., 2022).

Nevertheless, there are also indications of a certain level of alignment in how the concept of sustainability is implemented among ECE teachers in South-Eastern Europe who participated in the study. Specifically, no differences were found in the level of implementation of education for social sustainability (ESS) among participants from the three countries. Moreover, the results showed that ESS was the most prominently implemented dimension of ECEfS, which aligns with findings from recent studies conducted with ECE teachers in the respective countries (Anđić, 2024; Lepičnik Vodopivec & Šindić, 2025; Šindić et al., 2022). Additionally, no statistically significant differences were found regarding the implementation of integrated ECEfS or the overall sustainability outcomes (O-SD), including children's sustainable behavior (SB). The findings of a previous study by Šindić et al. (2022) also indicated no differences in the representation of integrated ECEfS implementation among participants from the three countries.

This situation may encourage further reflection on opportunities for regional engagement and mutual collaboration, with the aim of strengthening and harmonizing approaches to education for sustainable development in early childhood. Additionally, the interpretation of the results must take into account cultural and systemic educational differences across countries, which may affect the transferability of the findings. The implementation of ECEfS is often shaped by national education policies, curricular frameworks, and available training pathways for ECE teachers (Güler Yıldız et al., 2021; Kahriman-Pamuk & Borg, 2024; Višnjić-Jevtić et al., 2022). While some countries offer more structured and continuous professional development—both formal (e.g., university-level programs) and non-formal (e.g., institutional training, online modules, eco-programs)—others rely more heavily on informal learning and individual teacher initiative. These differences may partially explain the uneven representation of sustainability dimensions observed among participants from different national contexts. As Feriver et al. (2023) emphasized, transformative engagement with ECEfS requires not only access to professional development but also reflective and context-sensitive approaches, which are often culturally and systemically embedded. Therefore, future efforts to enhance ECEfS implementation should consider aligning training content with the diverse socio-educational realities of early childhood systems across countries.

The results indicate that ECE teachers working in eco-kindergartens implemented the ecological, economic, and integrated dimensions of education for sustainable development to a significantly greater extent than their counterparts in non-network institutions. Furthermore, children in eco-kindergartens exhibited a higher level of sustainable behavior compared to their peers in kindergartens outside the network. However, no significant differences were found in the domains of social sustainability, sustainability knowledge, or overall outcomes, suggesting that eco-programs may either place less targeted emphasis on these aspects or that all institutions, regardless of network affiliation, foster them equally. These insights align with findings reported in a recent study conducted by Poje et al. (2024), which showed that children attending eco-programs in Croatian preschools achieved higher outcomes in areas related to sustainability compared to their peers outside such programs. Similar results were observed in Slovenian study, where kindergartens implementing eco-programs demonstrated more advanced integration of ecological and economic aspects of sustainability, along with more pronounced sustainable behavior among children—links commonly associated with the holistic approach typical of eco-kindergartens (Lepičnik Vodopivec & Šindić, 2025). The authors emphasize that in eco-kindergartens, ecological, economic, and social aspects of sustainability are interconnected and coherently addressed, which may be the result of the systematic integration of eco-content into the everyday activities and life of the institution. These findings confirm that the continuous and intentional implementation of ECEfS in daily practice can contribute to the development of stable patterns of sustainable behavior already in early childhood (Ginsburg & Audley, 2020; Mahat et al., 2016), particularly through nature-based activities that are engaging and developmentally appropriate for young children (Hughes, 2023; Kuo et al., 2019), such as outdoor play (Ernst et al., 2021). Given that ECE teachers from Bosnia and Herzegovina involved in the research reported lower levels of implementation of both the ecological and economic dimensions of ECEfS, and also assessed children's sustainable behavior (SB) in their groups as less developed compared to their



counterparts in Croatia and Slovenia, one possible explanation may lie in the country's lack of participation in the Eco-Schools/Eco-Kindergarten network. As a result, ECE teachers may lack the institutional support necessary for the advancement of ECEfS. These findings highlight the importance of institutional support for the consistent and comprehensive implementation of ECEfS.

Familiarity with the activities of the ECE Academy course may be associated with higher-quality implementation of ECEfS, as ECE teachers familiar with this content were found to implement education for economic sustainability (EEcS) more prominently—a dimension that is otherwise the least represented in regular sustainability practices in kindergartens (Lepičnik Vodopivec & Šindić, 2025). Furthermore, children in their groups demonstrated a higher level of understanding of basic sustainability concepts (FSE) and achieved higher overall sustainability outcomes (O-SD), indicating the potential benefits of this form of professional development for ECE teachers within the framework of ECEfS. On the other hand, differences in the implementation of education for ecological sustainability (EES), social sustainability (ESS), the integrated approach (ECEfS), and observed sustainable behavior of children (SB) were not statistically significant, although average values in these domains were also slightly higher among teachers familiar with ECE Academy activities. The results indicate notable progress, particularly in the area of education for economic sustainability (EEcS)—a field traditionally least present in ECE programs. This shift points to the potential of individual ECE teacher engagement in improving sustainable practices, especially when flexible and innovative forms of non-formal professional development are available, such as online platforms that provide engaging, tailored, and individualized approaches to professional learning. Such an approach can further empower ECE teachers to more deeply integrate the principles of sustainability into daily practice, thereby contributing to the achievement of ECEfS goals. Findings from other studies also suggest that the implementation of ECEfS in the observed region is often driven by the personal enthusiasm of ECE teachers and their willingness to pursue additional non-formal education (Višnjić-Jevtić et al., 2022), which is further supported by the results of this study. Feriver et al. (2023) have emphasized that genuine transformation toward sustainability education requires the active engagement of ECE teachers, particularly through the practice of critical reflection and transformative learning. Their research highlights that the content, context, and delivery of professional development are crucial in fostering reflective practice, and consequently, in shaping more sustainable educational approaches. The fact that less than one-quarter of ECE teachers were familiar with the activities of the ECE Academy course (Table 1) may point to a lack of awareness among education professionals about available forms of non-formal professional development. This result could indicate the need for relevant educational institutions and policy frameworks to recognize and support such innovative programs, and to systematically integrate them into official professional development strategies, making them available to individuals through regular programs, projects, and initiatives. ECE teachers play a pivotal role in implementing ECEfS, as they create the environments in which children begin to develop awareness and capacity for sustainable action from an early age (Ärlemalm-Hagsér & Sandberg, 2017; UNESCO, 2017). However, the complexity of sustainability—along with the challenge of integrating its ecological, social, and economic dimensions—often leads to a lack of clarity among educators (Kioupi & Voulvoulis, 2019; Višnjić-Jevtić et al., 2022). Prior research has shown that ECE teachers apply diverse approaches to ECEfS (Šindić & Lepičnik Vodopivec, 2025), reflecting variation in interpretation, resources, and levels of preparation. These findings underscore the need for targeted, continuous, and context-sensitive professional development (Lepičnik Vodopivec & Šindić, 2025; Višnjić-Jevtić et al., 2022).

Conclusions and Implications

The findings of the study indicated that the implementation of education for sustainable development in early childhood (ECEfS) among participants from the three observed countries exhibited both shared characteristics and country-specific differences. While ECEfS and its outcomes were implemented to a similar extent, differences were observed in the representation of certain dimensions—primarily economic and ecological sustainability—in the degree of sustainable behavior adoption among children. These differences suggest that contextual factors may shape how sustainability is embedded in early childhood practices across diverse settings.

The results point to the potential for improving ECEfS through joint strategies and regional cooperation. It is particularly noteworthy that ECE teachers from eco-kindergartens, as well as those familiar with the activities of the ECE Academy course, reported a greater presence of sustainable practices in their own work and a higher level of sustainability-related outcomes in children. This supports the importance of institutional support and continuous professional development, including through non-formal education channels.



Although the results did not yield a fully uniform picture, it is evident that there is a genuine interest in sustainability and that ECE teachers play a key role in transmitting sustainable values to children. The observed differences in the implementation of ECEfS aspects and in the achievement of sustainability outcomes—across countries, institutions, and individuals with varying levels of motivation for professional development—suggest that both collective and individual efforts are essential for progress. This further underscores the importance of individualized approaches to professional development, which consider ECE teachers' varying levels of motivation, prior knowledge, and work contexts.

The hypotheses were partially confirmed, indicating the importance of support through institutional and professional factors, and highlighting the need to remain open to innovative approaches to professional development that are characteristic of the digital age. For this reason, it is essential to enhance ECE teacher training, foster supportive professional environments, and encourage the exchange of experiences among countries, educational institutions, and individuals. Ultimately, sustainable development does not begin with systems—it begins with individuals who live and model it daily for the youngest generations.

Given the convenience sampling, the results cannot be fully generalized to all ECE teachers in the observed countries; however, they provide valuable insight into differences that merit further investigation. One limitation of the study is its reliance solely on self-reports by ECE teachers. To achieve greater objectivity and a deeper perspective, future research should include the perspectives of children, families, and institutional leaders. Furthermore, the inclusion of qualitative methods—such as interviews, observations, or case studies—would allow for deeper contextual insight and help to uncover the mechanisms behind the observed variations in sustainability outcomes. Given the regional focus on three countries, future research would benefit from exploring similar questions across a wider range of national settings, thereby enhancing the international applicability of findings. Despite these limitations, the study contributes valuable evidence that can inform both policy and practice, while highlighting the importance of individualized, context-sensitive, and continuous professional development opportunities for ECE teachers engaged in education for sustainable development.

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Declaration of Interest

The authors declare no competing interest.

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